

# SUSTAINABILITY OF FOOD SECURITY, SAFETY, and NUTRITION Role of Science and Technology

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# OUTLINE

- Sustainable Development Goals 2030
- Challenges for SDGs' Achievements
- Food Security System Approach
- Role of Science and Technology
- Mission Oriented Research

# Sustainable Development Goals 2030

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<https://sustainabledevelopment.un.org>)



# Sustainable Development Goals 2030

- End of poverty in all its forms
- End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Ensure healthy live and promote well being for all ages
- Ensure inclusive and equitable quality education and promote life long learning
- Achieve gender equality and sustainable management of water and sanitation
- Ensure access to affordable, reliable, sustainable and modern energy
- Promote sustain, inclusive and sustainable economic growth, full and productive employment and decent work
- Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- Reduce inequalities both within and between countries
- Make cities and human settlement inclusive, safe, resilient and sustainable
- Ensure sustainable consumption and production patterns
- Take urgent actions to combat climate changes and its impacts
- Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- Protect restore and promote sustainable use of terrestrial ecosystems
- Promote powerful and inclusive societies for sustainable development, provide access to justice for all, and held effective accountable and inclusive institutions
- Strengthen the means of implementation and revitalize the global partnership for sustainable development

# Challenges for SDGs' Achievements

# Challenges on SDGs Achievements

- Primary production are depending on the actions taken on Climate change, life below the water and on land (SDGs 13, 14, 15)
- Need to increase output throughout food chain to end hunger achieve food security and improved nutrition, promote sustainable agriculture to ensure healthy lives and promote well being (SDGs 2 and 3)
- World's food supply will depend on the industries of food manufacture and distribution and the skills necessary to innovate (SDGs 4 and 9)

# Inter Academy Partnership Recommendations for Sustainability (2018) ~ S20

## Report from Europe, Asia, the Americas, Africa

1. Ensuring sustainable food production (land and sea), sustainable diets and sustainable communities, including issues for agricultural transformation in face of increasing competition for land use.
2. Promoting healthy food systems and increasing the focus on nutrition, with multiple implications for diet quality, vulnerable groups, and informed choice.
3. Identifying the means to promote resilience, including resilience in ecosystems and in international markets.
4. Responding to, and preparing for, climate change and other environmental and social change.
5. Requires food technology to be increasingly aware of how consumption is linked to economic, demographical and cultural change, and individual human health requirements.
6. Food systems are in transition: living within planetary boundaries (including those for nutrients, water and climate) and having healthy populations requires new approaches to food systems.
7. There is need to build critical mass in research, teaching and innovation and to mobilize those resources in engaging with policy-makers and other stakeholders.



# Food Security System Approach

# System approach for FOOD SECURITY

## Agri-Health: The Basic Concept

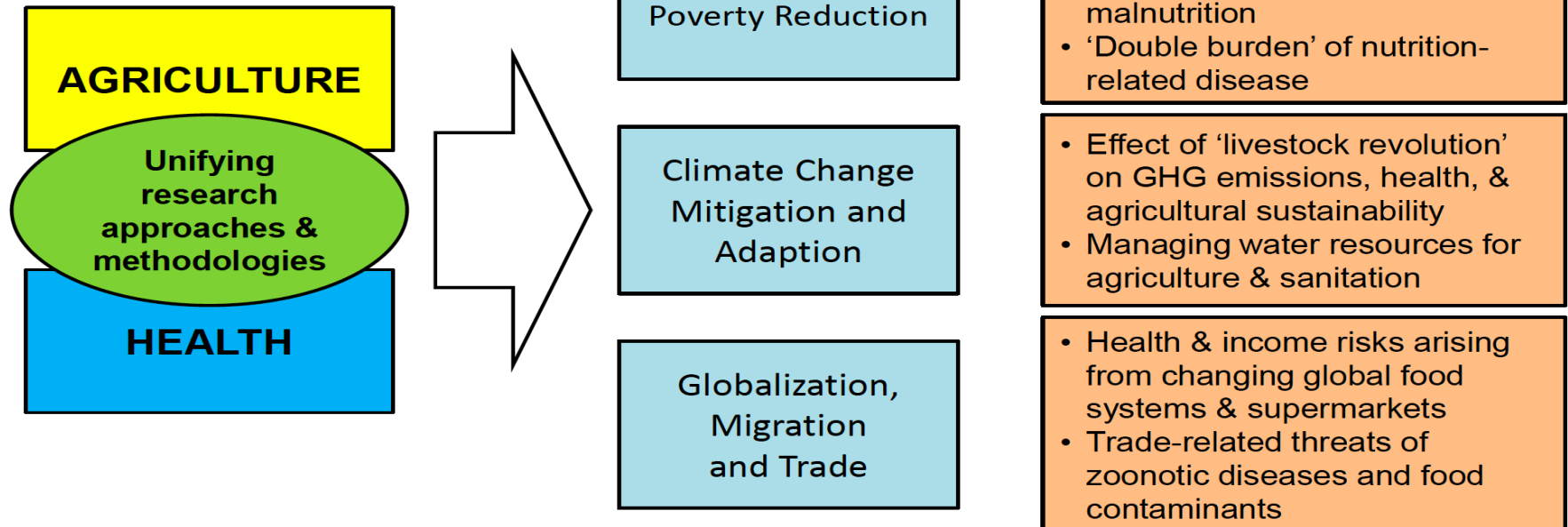
Developing a  
New **Agrihealth**  
Paradigm



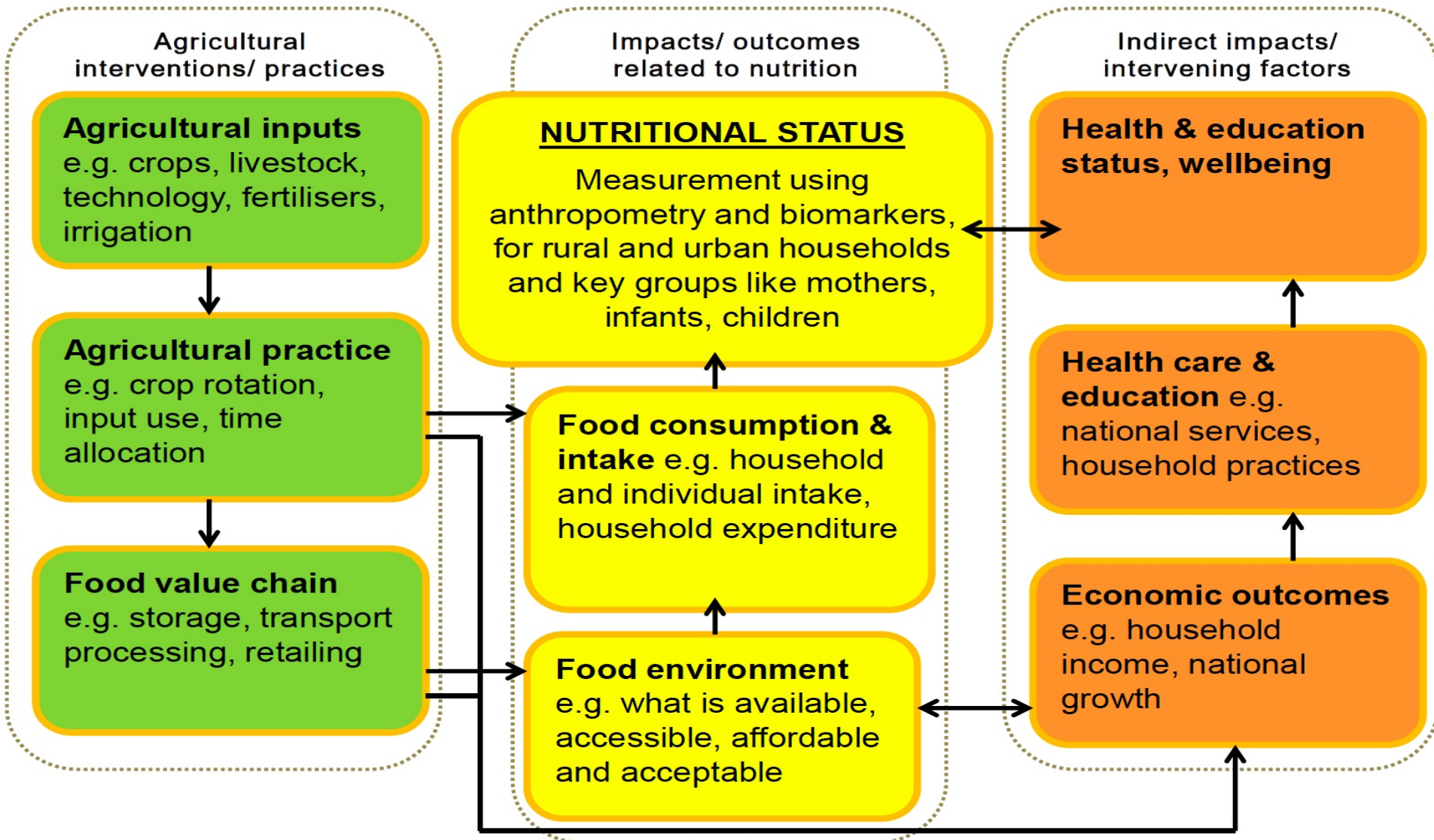
Improves  
understanding  
**complex**  
**global** issues



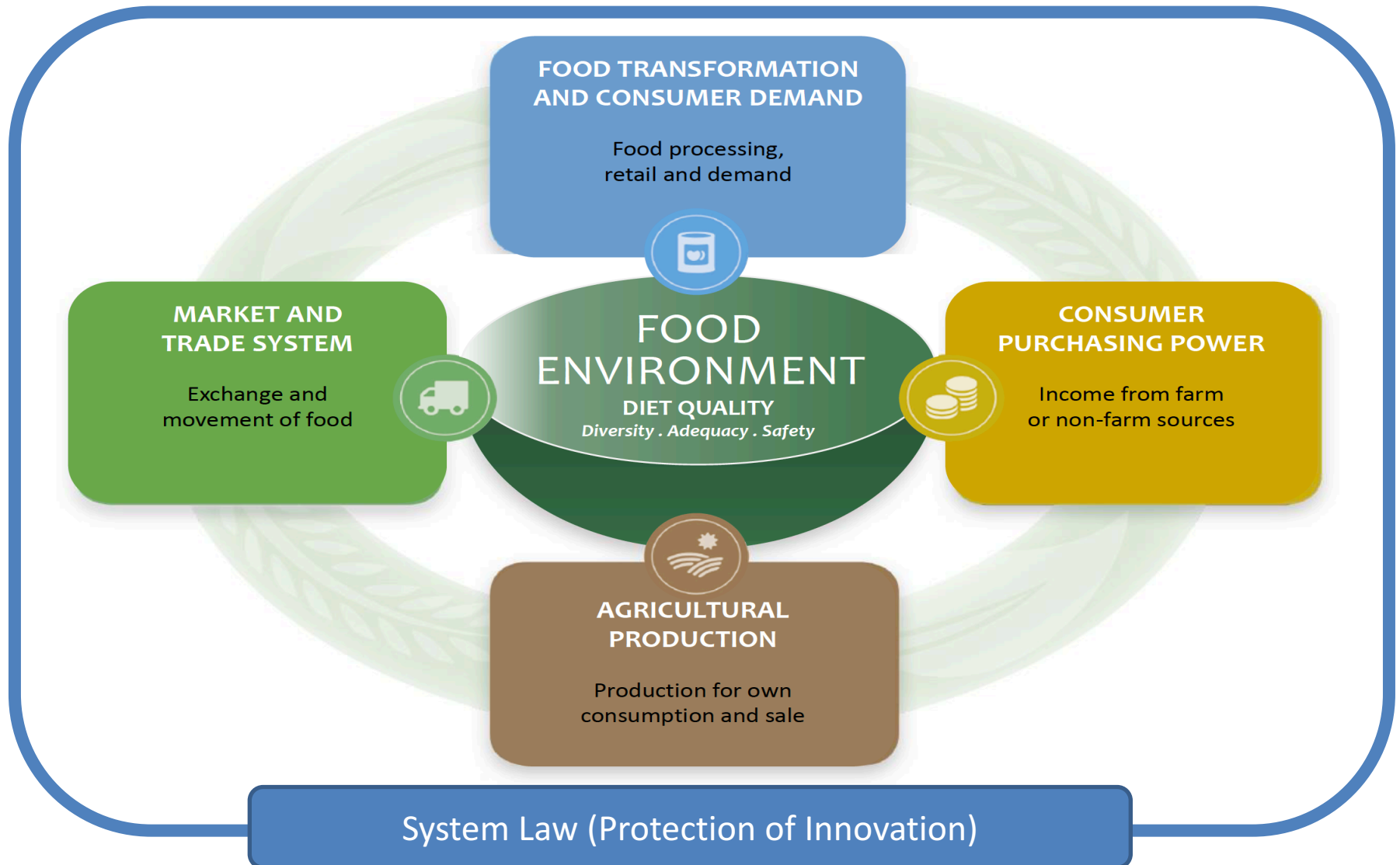
By giving us  
**tools** to address  
problems like



# System approach for FOOD SECURITY

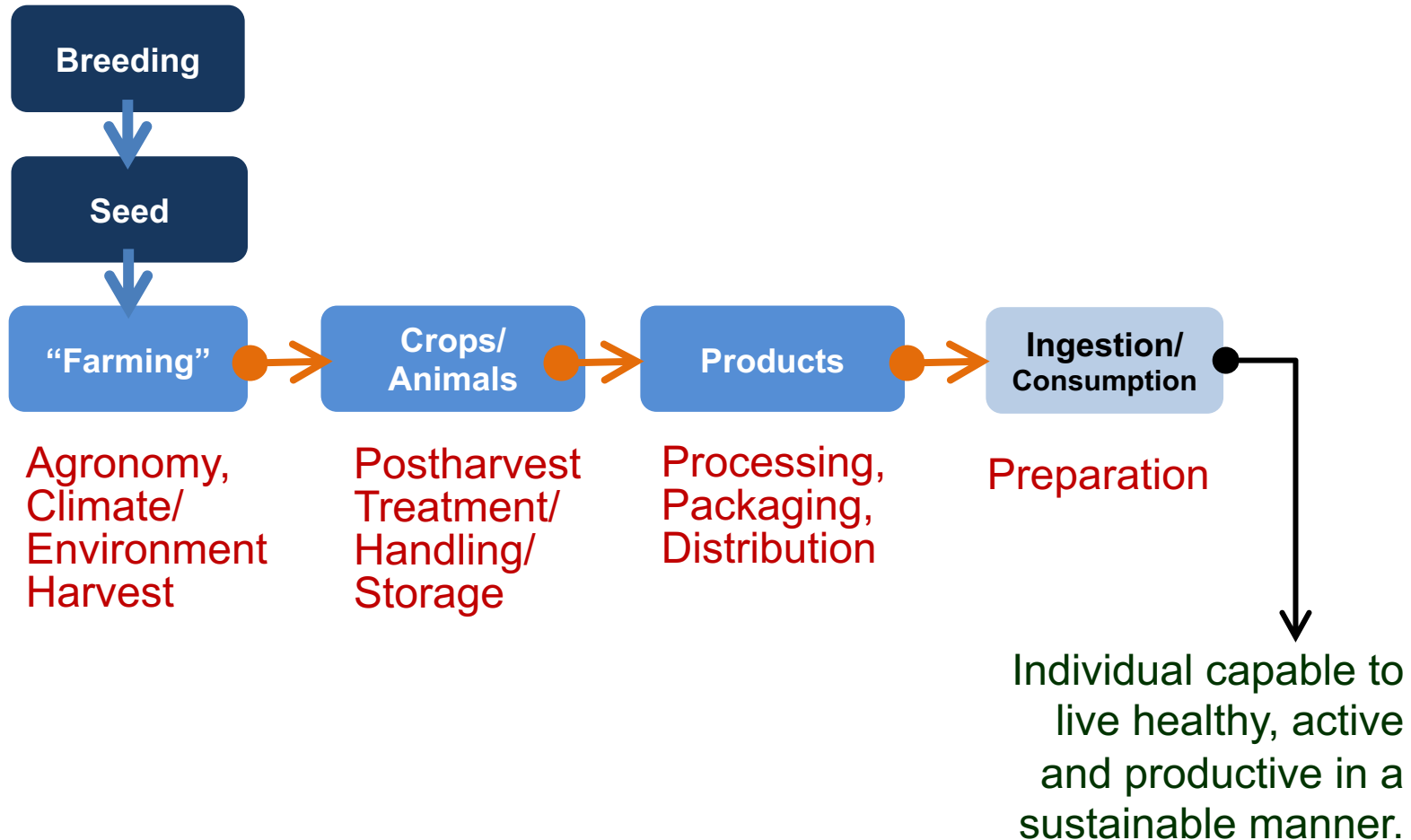


# System approach for FOOD SECURITY



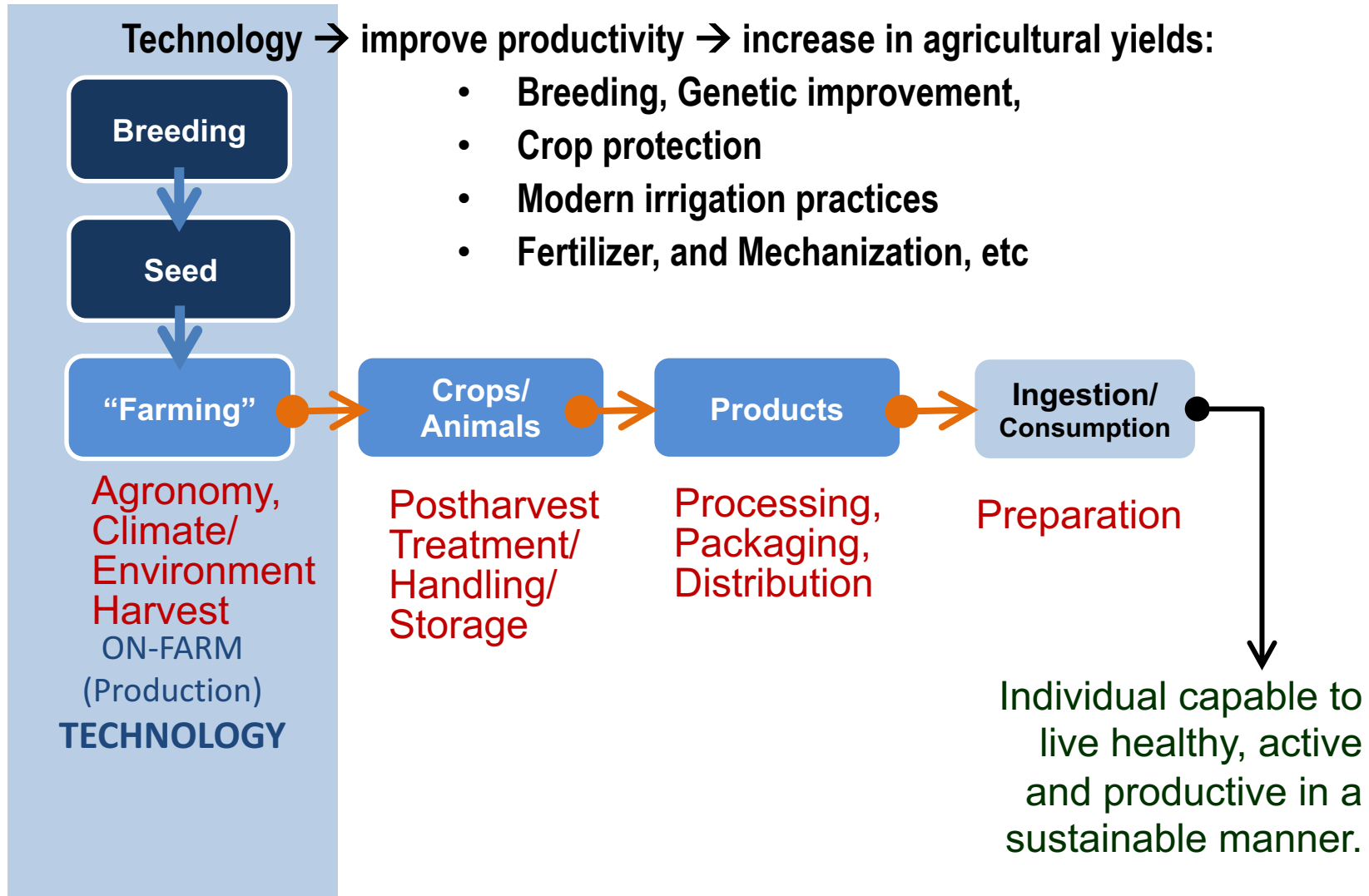
# The Role of Science and Technology

# The Role of SCIENCE & TECHNOLOGY on Food Security throughout Value Chains



# The Role of On-Farm Technology on Food Security

1

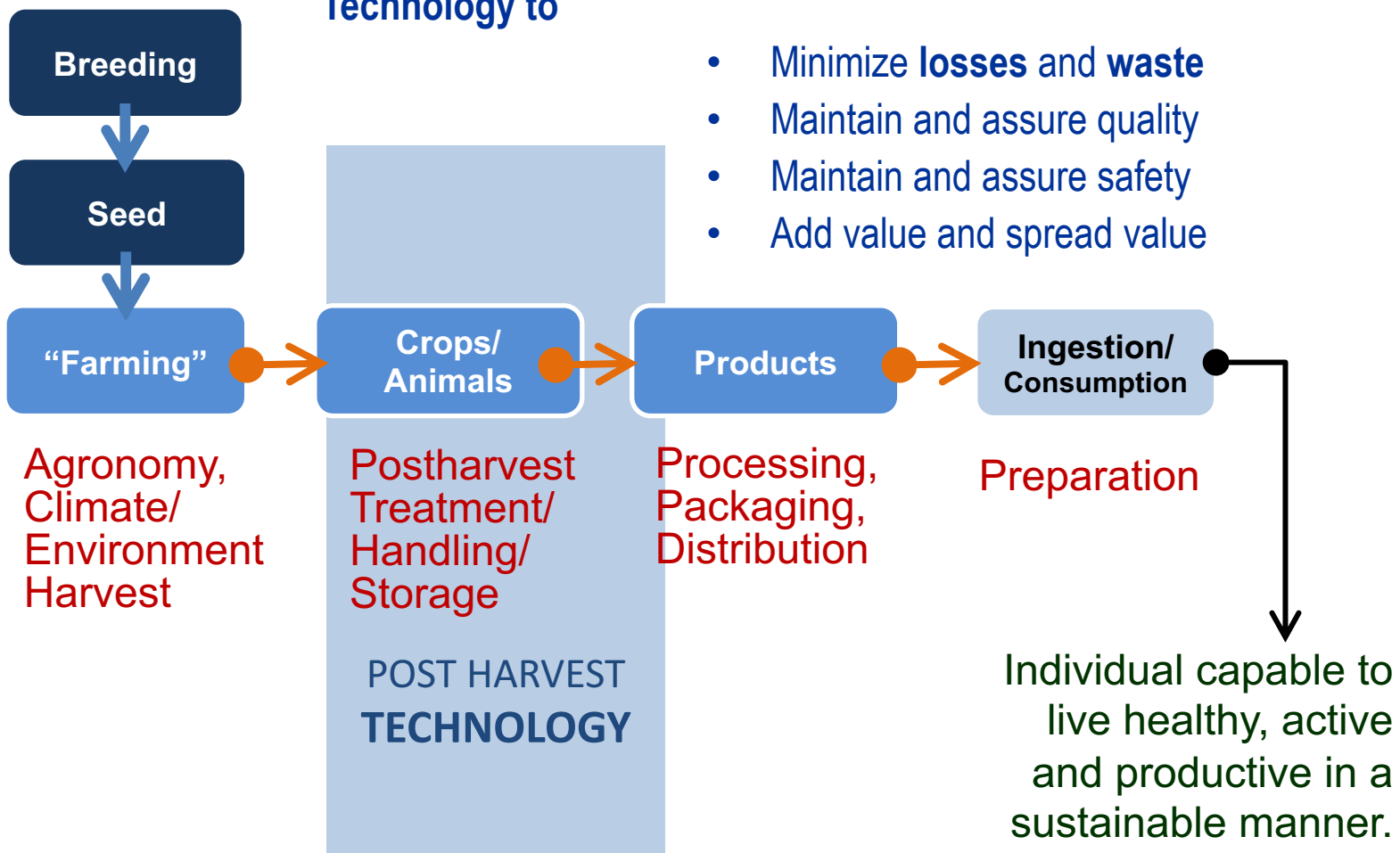


# The Role of Post Harvest Technologies on Food Security

2

## Post Harvest Technologies

Technology to



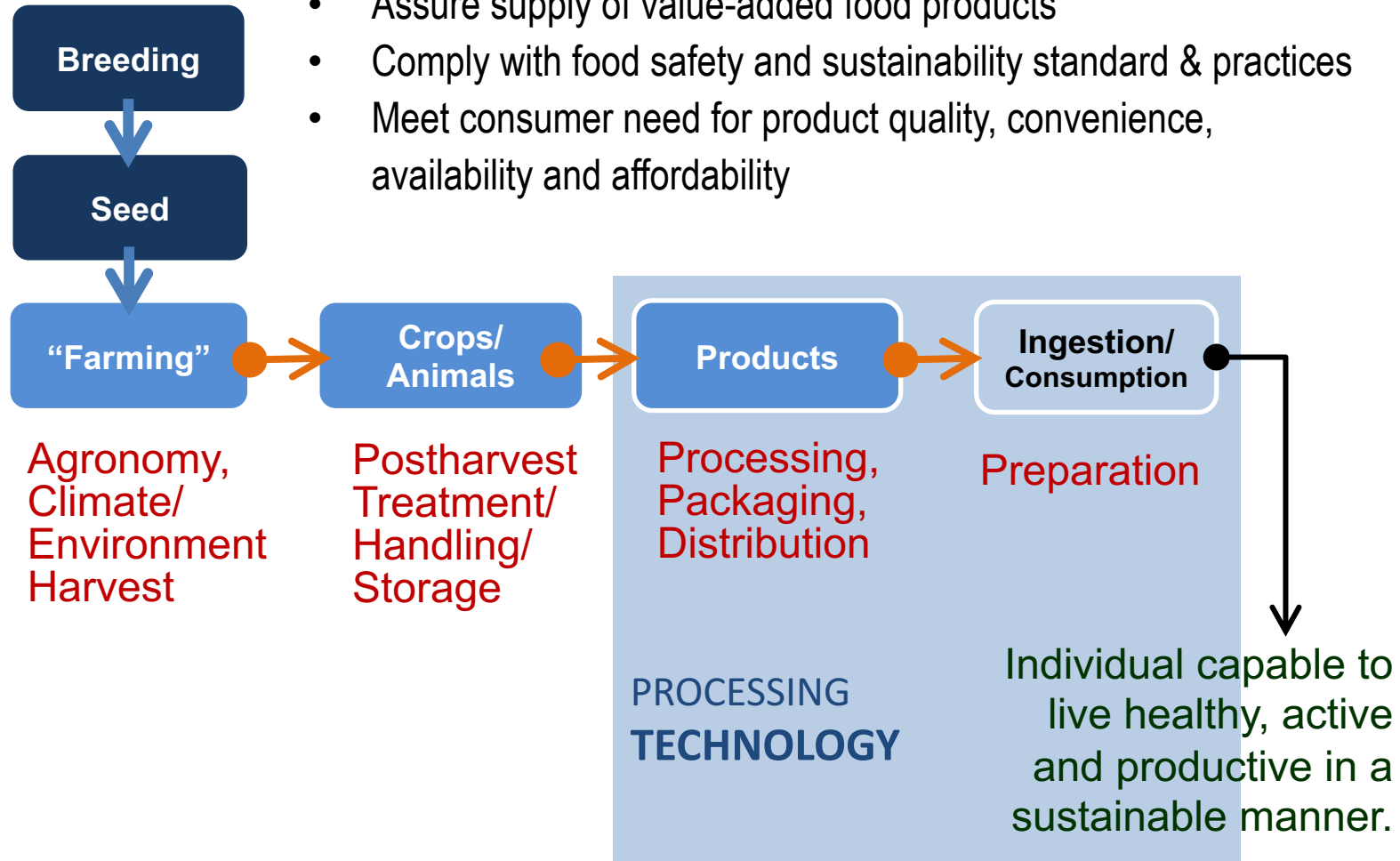


# The Role of Processing Technologies on Food Security

3

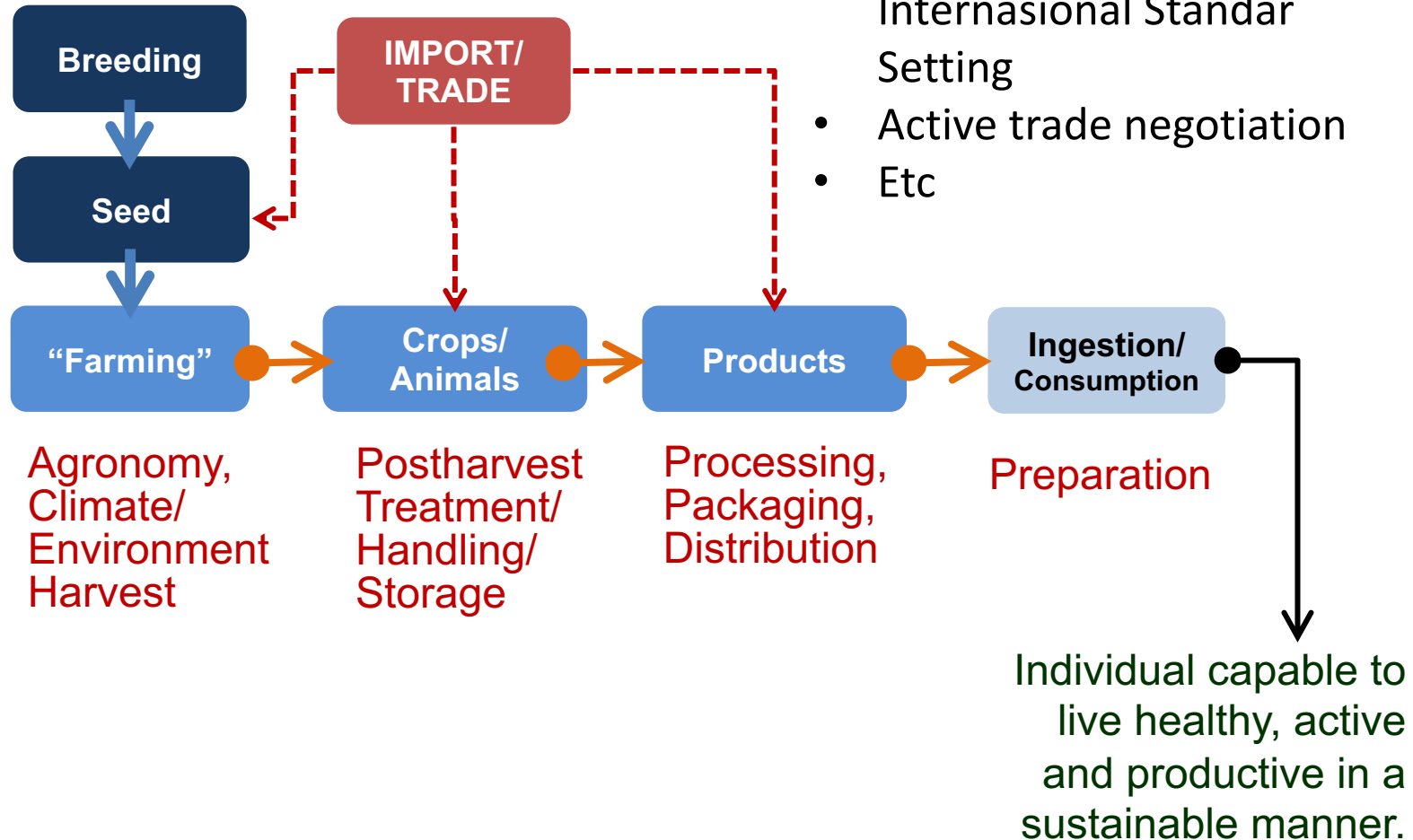
**Processing Technology** to:

- Assure supply of value-added food products
- Comply with food safety and sustainability standard & practices
- Meet consumer need for product quality, convenience, availability and affordability



# The Role of International Trade on Food Security

4



# IUFoST's Recommendations on Mission Oriented Research (2018)

- **Mission - 1: To introduce more diverse and sustainable primary production**
  - To develop accurate tests for the functionalities of new raw materials (crops and animals) and ingredients, in conversion processes and final product performance
  - To understand and control the behaviour of raw materials and ingredients in the unit operations of conversion to foods, relating their materials science to the kinetics of conversion.
  - Themes: Yields and functional performance of commodity crops, novel and “orphan” crops, Animal protein replacement, Food from the sea (marine plants), Insects

# IUFoST's Recommendations on Mission Oriented Research (2018)

- **Mission - 2 To develop new processes and systems, to ensure more sustainable manufacture**
  - To further develop precision engineering to reduce and recycle water and heat across all the unit operations of conversion, cleaning and preservation. (This may include novel unit operations, such as high pressure, PEF, ultrasound etc, where their extra efficiencies can be utilized.)
  - To develop conversion processes which cause minimal damage to reactive micronutrients
  - To develop low temperature conversion via enzymic and fermentative processes
  - To improve drying and rehydration to minimize product and ingredient weight in distribution, while maintaining function and performance
  - To explore the relative merits of centralized versus distributed manufacture for sustainability for example, by scaling down existing processes for local applications without loss of operational efficiency
  - To promote the harmonization of metrics of sustainability measurement, of product and process from primary production to end of life.
  - Themes: Process Engineering (precision engineering), new unit operations, micronutrient sensitivity, bioprocessing, packaging, system engineering

# IUFoST's Recommendations on Mission Oriented Research (2018)

- **Mission - 3 To eliminate material waste in production, distribution and consumption**
  - To improve storage stability of primary produce, to cope with inefficient transport and downstream use; by developing low energy drying, chill and frozen distribution using solar energy and other forms of sustainable power.
  - To develop rapid sensors of :- primary product condition and safety; eating quality and nutrient status of finished products.
  - To restructure the ingredients and food assembly industries to add value to all side streams.
  - To engage with packaging producers, allowing reduced levels of petrochemical materials in products, and development of novel forms (recyclable, bio-based materials etc.)
  - Themes: Science and technology of preservation, Sustainable bio-economy

# IUFoST's Recommendations on Mission Oriented Research (2018)

- **Mission – 4 To establish complete product safety and traceability**
  - To make best practice in food safety available globally.
  - To develop validated rapid methods for identification and quantification of toxins, allergens, pathogenic and spoilage organisms across the food chain
  - To understand the epidemiology of microbial growth and genetic variation in the food environment.
  - To prevent the transfer of resistant (AMR) organisms to the food chain, working with veterinarian and medical microbiologists.
  - To provide traceability of products by introducing robust documentation of product histories, including primary source, processing methods and labour utilisation, product composition and safety
  - Themes: Delivery safe products, microbial resistance, processing with enzymes and culture, traceability

# IUFoST's Recommendations on Mission Oriented Research (2018)

- **Mission - 5 To provide affordable and balanced nutrition to the malnourished**
  - All the critical needs identified in Missions 1-5 must be fulfilled. and there is a further need-
  - To reformulate food composition and modify processing so that balanced nutrition, convenience. and consumer acceptability is provided at low cost.
  - Themes: the Agrarian poor in subsistence farming, the Urban poor and “Hidden Hunger”

# IUFoST's Recommendations on Mission Oriented Research (2018)

- **Mission – 6 To improve health through diet**
  - To measure the release of nutrients from whole foodstuffs both in position and time throughout the alimentary tract.
  - To make use of metabolomics to detect responses to different foods and diets
  - To identify feed forward and feedback signaling from nutrients to brain activity and hence the regulation of organ activity and whole-body metabolism.
  - To determine the extent to which genotype and metabolic phenotype determines the responses to diet, within existing dietary groups.
  - To establish more specific information of the nutrient needs of individuals within established nutritional groups for precise advice on diets.
  - To validate the impact of “nutraceuticals” on health, using cohort studies and market data, within realistic diets.
  - To identify the combined effects of macro and micronutrients on long term health via diet.
  - Themes: Nutrient release by physical processes in the alimentary canal, Genomics and Metabolomics, Precision Nutrition (Groups vs Individuals), Health Foods (Medical foods, nutraceuticals, Functional Foods, Superfoods)



# IUFoST's Recommendations on Mission Oriented Research (2018)

- **Mission – 7 To integrate Big Data, Information Technology and Artificial Intelligence throughout the Food Chain.**
  - To use multivariate data to construct self-consistent models for material/process interactions in food manufacture.
  - To collaborate with the biological sciences to identify statistical and causal relationships between Diet and Health.
  - To provide validated data, and develop secure methods to link information flows between Production, Distribution and Consumption, thereby enhancing traceability, standardizing safety, and reducing costs and waste.
  - Themes: Models for ingredient and product manufacture (design and build), Diet and health, Food Chain Management (Distributed Ledger Technology ~Block Chain")

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Thank You/Terima Kasih